SQFlash SMART ID Definition

(For 830, 910, 640 Series)

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1. Table of SMART ID

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
01h	Raw_Read_Error_Rate	Uncorrectable ECC Count					
09h	Power_On_Hours	Power on Hours					
0Ch	Power_Cycle_Count	Power on/off counts					
0Eh	Device Capacity	0	0	Device Capacity			
0Fh	User Capacity	0	0	User Capacity			
10h	Initial Spare Blocks Available	0	0	Total Available Spare Block			
11h	Spare Blocks Remaining	0	0	Remaining Spare Block			
64h	Total Erase Count	0	0	Total Erase Count			
A8h	SATA PHY Error Count	SATA PHY Error Count					
AAh	Bad Block count	Later Bad		0	0	Early Bad	
ADh	Erase count	0	0	Avg. Erase		Max Erase	
AEh	Unexpected Power Loss Count	0	0	Unexpected Power Loss Count			
AFh	Power Failure Protection Status	Voltage Stabilizer Trigger Count				Guaranteed Flush (0x01 Enable)	Drive Status (0x00 Normal)
C0h	Unexpected Power Loss Count	0	0	0	0	Unexpected Power Loss Count	
C2h	Temperature	Max Temp.		Min Temp.		Current Temp.	
CAh	Percentage of Spares Remaining	0	0	0	0	0	SSD Life Used
DAh	CRC error	CRC Error Count					
E7h	SSD Life Remaining	0	0	0	0	0	SSD Life Left
EAh	Total NAND Read	Total NAND Read (Sector, 512B)					
EBh	Total NAND Written	Total NAND Written (Sector, 512B)					
F1h	Total Host Write	Host Write (Sector, 512B)					
F2h	Total Host Read	Host Read (Sector, 512B)					

2. How to look up table

The raw data you get from the SQFlash Utility is Hex code, so you need to look up the table and transfer the Hex data to decimal data. Please refer to the below example:

I get the Temperature value from SSD.

| C2 | Temperature | 001D0018001A |

The Raw data is 001D0018001A. After I look up the table and separate the Raw data in to 3 value as below table.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
C2h	Temperature	Max Temp.		Min Temp.		Current Temp.	
		001D		0018		001A	

And then I can get 3 value,

      Max Temp.   = 001D (Hex)   = 29 (decimal)

      Min Temp.   = 0018 (Hex)   = 24 (decimal)

      Current Temp. = 001A (Hex)   = 26 (decimal)

3. SMART ID Statement

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
01h	Raw_Read_Error_Rate	Uncorrectable ECC Count					

Uncorrectable ECC Count is data error coding between SSD controller and NAND flash. This value need to be 0. If the value is not 0, there may be some problem between SSD controller and NAND flash.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
09h	Power_On_Hours	Power on Hours					

Power on Hours is a counter that counts the power on time of the SSD, and the unit is hour.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
0Ch	Power_Cycle_Count	Power on/off counts					

When SSD has one power on and power off cycle, the counter will add one.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
0Eh	Device Capacity	0	0	Device Capacity			

This value is the capacity of the storage, each count equals to 512 Byte.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
0Fh	User Capacity	0	0			User Capacity	

This Value is the capacity that user can use, each count equal to 512 Byte.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
10h	Initial Spare Blocks Available	0	0			Total Available Spare Block	

The spare block counts when the SSD is newly made.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
11h	Spare Blocks Remaining	0	0			Remaining Spare Block	

The current available spare blocks.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
64h	Total Erase Count	0	0			Total Erase Count	

Sum of erase count from all blocks.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
A8h	SATA PHY Error Count				SATA PHY Error Count		

SATA PHY Error Count will record all PHY error count (ex data FIS CRC, code error, disparity error, command FIS CRC….). This value will reset to zero, after power off. If you found a lot of SATA PHY error, please help to use new SATA cable or check if the SATA connector is loose or not.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
AAh	Bad Block count	Later Bad	0	0		Early Bad	

Block is a capacity unit of NAND flash. And the bad block is the damaged block that SSD controller mark as "no use". There are two kind of bad block, one is Early bad block, another one is Later bad block.

  ➢ Early bad block is the bad block that caused during manufacture. SQF standard is less than 2%.

  ➢ Later bad block is caused by artificial usage. If the block has too many ECC, the SSD controller will mark the block as Later bad block. But it also need to check the erase count. If the SSD is going to run out of their lifetime, the Later bad blocks are normal.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
ADh	Erase count	0	0	Avg. Erase		Max Erase	

Erase count is the parameter that we check the lifetime of the SSD. There are two kind of erase count, one is average erase count and another one is max erase count.

  ➢ Average erase count is the average of all block's erase count.

  ➢ Max erase count is the biggest erase count of all blocks.

The endurance of the SSD will depend on NAND flash type, please refer to the below table:

NAND flash type	Endurance (times)
MLC	3,000
UltraMLC	30,000
SLC	100,000

For example, if the average erase count of the MLC SSD is over 3,000 times, it means the SSD is run out of their lifetime.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
AEh	Unexpected Power Loss Count	0	0			Unexpected Power Loss Count	

If SSD power off before host issue standby command, the Unexpected Power Loss Count will add 1.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
AFh	Power Failure Protection Status	Voltage Stabilizer Trigger Count				Guaranteed Flush (0x01 Enable)	Drive Status (0x00 Normal)

The status of power failure protection related functions.
- ➢ Voltage Stabilizer Trigger Count: the count of how many times Voltage Stabilizer circuit has been triggered.
- ➢ Guaranteed Flush: the feature on/off status
- ➢ Drive Status: error code of power failure protection related functions

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
C0h	Unexpected Power Loss Count	0	0	0	0	Unexpected Power Loss Count	

If SSD power off before host issue standby command, the Unexpected Power Loss Count will add 1.

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
C2h	Temperature	Max Temp.		Min Temp.		Current Temp.	

Current Temperature / Minimum Temperature / Maximum Temperature

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
CAh	Percentage of Spares Remaining	0	0	0	0	0	SSD Life Used

SSD Life Used, in percentage, calculated by average erase count and NAND reference erase count.

SSD Life Left = (Avg. erase count / endurance)%

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
DAh	CRC error	CRC Error Count					

CRC error is the data error coding between controller and host. If the CRC error count is not 0, it means the SATA signal is not good. Please help to check the SATA trace from HOST (PCB layout, SATA cable, SATA connector).

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
E7h	SSD Life Remaining	0	0	0	0	0	SSD Life Left

SSD Life Left, in percentage, calculated by average erase count and NAND reference erase count.

SSD Life Left = 1 – (Avg erase count / endurance)%

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
EAh	Total NAND Read	Total NAND Read (Sector, 512B)					

The total data size that SSD controller read from NAND flash. The unit is sector (512Byte).

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
EBh	Total NAND Written	Total NAND Written (Sector, 512B)					

The total data size that SSD controller write to NAND flash. The unit is sector (512Byte).

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
F1h	Total Host Write	Host Write (Sector, 512B)					

The total data size that Host write to SSD. The unit is sector (512Byte).

ID	ATTRIBUTE_NAME	DATA ADDRESS (Byte)					
		10	9	8	7	6	5
F2h	Total Host Read	Host Read (Sector, 512B)					

The total data size that Host read from SSD. The unit is sector (512Byte).